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The Hong Kong Influenza Virus Epidemic in the USSR *

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An epidemic wave of influenza associated with the A2/Hong Kong/68 virus reached the USSR in the second 10-day period of December 1968. During the first quarter of 1969 the epidemic involved almost all cities of the Soviet Union. The intensities of the rise and of the fall of the 1969 epidemic wave were less pronounced than those of the 1965 influenza A2 epidemic, but were more extended. In most towns the epidemic lasted 50–80 days whereas in 1965 the epidemic in towns lasted 25–30 days.

The influenza caused by A2/Hong Kong/68 was characterized by an unusual age-group distribution. Children under 7 years of age made up only one-quarter of the total influenza cases during the peak of the epidemic wave in most communities. The clinical course of the disease was, in the main, of average severity, there being no significant differences in symptoms compared with influenza caused by virus A2.

Analysing the influenza epidemics associated with influenza A2 virus during recent years one may note peculiar features of the A2 Hong Kong/68 influenza epidemic. On the one hand, these are apparently connected with the shifts in antigenic character of the virus, and, on the other hand, with the timely arrangements undertaken by public health services to prepare for the influenza epidemic, i.e., the carrying out of prophylactic and anti-epidemic measures.

Influenza has been known to mankind since antiquity, but the problem of controlling the disease has so far not been solved. Each year many investigations in the Soviet Union and other countries of the world are concerned with the study of influenza epidemiology, but in spite of this many aspects of the epidemiology of influenza and other acute respiratory viral infections have not been elucidated.

It is well known that influenza is a communicable disease freely disseminated from one continent to another. Each influenza pandemic initiated by a new variant of the virus is capable of invading all countries of the world within a short time. In the nineteenth century this period was from 3 to 4 years, whereas now, with the progress of civilization and transport, it is reduced to 1–1½ years.

Influenza is an infection with global prevalence; the study of its epidemiological characteristics throughout the world is very important and is supported by the World Health Organization. By means of regular exchanges of information between the World Influenza Centre in London and a network of national influenza centres we were able to follow the spread of the recent influenza epidemic associated with the A2/Hong Kong/68 influenza virus. The World Influenza Centre also provided us with the strain of A2/Hong Kong/68 influenza virus in good time.

MATERIALS AND METHODS

In the Soviet Union, a complete account of all cases of influenza and other respiratory diseases is ensured on the basis of the clinical diagnosis established at the time of the primary application for medical treatment. This surveillance is practised both during epidemics and between them. Data on the primary cases of influenza, including those in children under 7 years of age, are sent to the USSR Regional Influenza Centre from the different geographical zones; they are sent daily from 8 cities (Moscow, Leningrad, Kiev, Novosibirsk, Tashkent, Riga, Baku, Vladivostok) and at the end of each 10-day period from 55 towns. Regular statistical and epidemiological analysis of these data enables

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us to follow the spread and intensity of influenza and the other acute respiratory diseases (ARD) in different parts of the USSR in different years and in different seasons. In addition the USSR Regional Influenza Centre receives information monthly from 30 supporting virological laboratories about the number of patients examined and the number of cases of influenza and other ARD confirmed by laboratory tests (parainfluenza, adenoviral infections, respiratory syncytial viral infections, etc.). The results of the laboratory tests helped to elucidate the etiology of the above diseases as well as the main characteristics of the strains of influenza virus recovered in different regions during and between epidemics.

The USSR Regional Influenza Centre receives weekly information from WHO and exchanges reports of influenza morbidity with the national centres of some other eastern European countries. The information thus available enables the staff of the USSR Regional Influenza Centre to follow the beginning of an epidemic increase in incidence of influenza, the spread of an epidemic wave, its magnitude, the decline of this epidemic wave, and the total percentage of the population affected, including children under 7 years of age, in any part of the country.

Many years of epidemiological analysis of data on influenza and ARD morbidity in the USSR and other countries, regular surveys of influenza etiology, elucidation of the role of the variability inherent in viruses A and B on the epidemiology of influenza all support the studies on the forecasting of influenza incidence in the coming season. During the last 6 years our centre has worked out such predictions for the autumn–winter period and has forwarded them at the end of the summer to public health services for the timely preparation of the prophylactic measures involved in the control of influenza.

DEVELOPMENT OF THE HONG KONG INFLUENZA A2 VIRUS EPIDEMIC

A new epidemic broke out in Hong Kong in 1968 against the background of a subsiding influenza A2 epidemic that involved about 40 countries or territories of the world during the 11-month period from October 1967 to August 1968. It was associated with a new variant of the influenza A2 virus designated as A2/Hong Kong/1/68. Epidemics caused by this virus were recorded during the period from July to September in almost all countries of South-East Asia and Oceania. Later this variant of influenza A2 was transported by air and sea to the United States of America. In September 1968, separate local outbreaks, most frequently of a family type, began to appear in European countries. At the beginning of 1969, these outbreaks developed into an epidemic and in the first 3 months of the year the epidemic wave of influenza A2/Hong Kong/68 involved the USA, Canada and all countries of Europe.

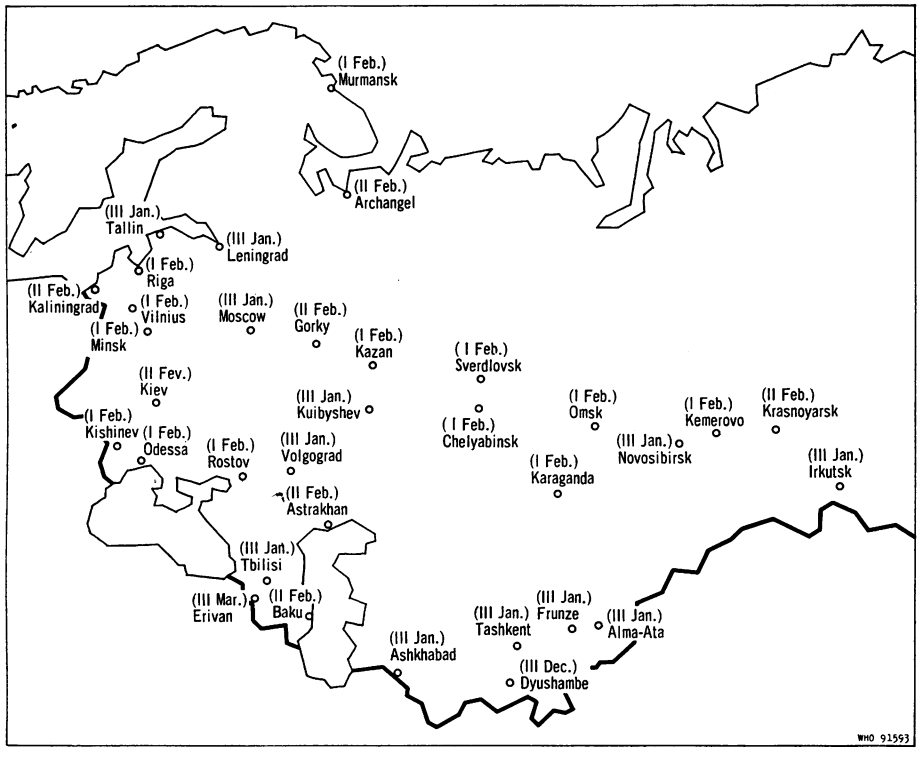
The advent of the pandemic strain of influenza A2 virus in 1957 resulted in the occurrence in the USSR of 4 epidemics associated with this virus. A fifth epidemic wave was observed in the winter of 1967, but it was of mixed etiology since influenza virus B circulated side by side with influenza A2 virus in many towns. A similar epidemic was registered in the USSR in 1959.

During the first quarter of 1968 the incidence of influenza and ARD in the USSR was high, the morbidity rate exceeding the indices of the inter-epidemic year (1964) by approximately 1½ times or even more. Influenza epidemics were recorded in such towns as Ufa, Kazan, Omsk and Ivanovo. However, they were not widely disseminated and an influenza epidemic was not recorded in the USSR as a whole.

In the USSR, cases of the disease associated with the influenza virus A2/Hong Kong/68 appeared in middle of December 1968 in a Moscow school and communities of adults in the Moscow region. Five strains of influenza virus A2/Hong Kong/68 were isolated. Further rapid spread of the illness was not observed. Almost simultaneously, i.e., during the second 10-day period of December, a considerable increase in influenza incidence was noted in the towns of Frunze and Dyushambe, where strains of the influenza virus A2/Hong Kong/68 were also recovered. The peak incidence in these towns was observed in the third 10-day period of December. In January the epidemic involved parts of the Central Asian and Transcaucasian regions of the USSR and the central part of the European region of the country and began to move towards Moscow, Leningrad and Tallin. In February the epidemic spread to the Baltic region and to Byelorussia, Ukraine, and Moldavia and moved eastwards to towns along the main railway line. Thus the influenza A2/Hong Kong/68 epidemic affected the whole country within 2 months (see Fig. 1).

FIG. 1

DISTRIBUTION OF THE A2/Hong Kong/68 INFLUENZA EPIDEMIC IN THE USSR IN 1968–69 [a]



[a] Roman numerals represent the first, second or third 10-day period of the month when maximum morbidity was recorded.

In Moscow and Leningrad simultaneous increases in influenza incidence began on Monday 6 January 1969, when the number of cases in Moscow was 2 times and in Leningrad 1½ times higher than on Friday 3 January 1969. The next Monday, 13 January 1969, showed a further 2-fold increase in influenza cases as compared with the incidence recorded on 6 January. The epidemic curve in these cities continued to rise almost until the end of January. The maximum number of clinical influenza cases was registered in Moscow on 27 January 1969 (almost 77 500) and in Leningrad on 28 January 1969 (almost 39 500). The morbidity subsided rather slowly. In Moscow, Riga, Kharkov, Alma-Ata and some other towns the epidemic declined very slowly, the morbidity rate remaining at approximately the same level during 1–1½ months. In April the number of influenza cases decreased but the number of ARD cases increased. It was May–June before the incidence of influenza and ARD reached the level characteristic of an interepidemic year.

In the main, the illness was of a disseminated character and no important epidemic foci were demonstrated: foci in families and blocks of flats were most frequently observed. An attack rate of 14%–25% was recorded in children under 7 years of age in all regions in the first quarter of 1969, the highest incidence being in children under 2 years of age. During the second quarter of 1969 the attack rate in children under 7 years of age increased to 30%–45%.

The clinical features of the influenza associated with the influenza virus A2/Hong Kong/68 did not differ significantly from those of influenza caused by the previous influenza A2 virus. Generally, the course of illness was of average severity. Pulmonary complications were the most common. Case fatality from influenza was no higher than in 1957.

During the first quarter of 1969 almost 21 000

patients were examined for influenza and ARD in the supporting laboratories. The immunofluorescent technique was employed in addition to other virological and serological methods. Influenza was confirmed in 60.2% of the total examined cases and, in addition, some 4% of the patients had a mixed infection, i.e., influenza in combination with adenoviral or parainfluenza or respiratory syncytial viral infections. The attack rate of other respiratory diseases in the first quarter of 1969 was as follows: parainfluenza and adenoviral infections, 4.8% and 4.7% respectively; respiratory syncytial viral infection, 6.5%. Relatively easy isolation of viruses was the general rule for types A2/Hong Kong/68 and A2. During the first 3 months of 1969 some 2000 strains of influenza virus A2 were isolated and typed. During the study of the isolated viruses, attention was mainly focused on antigenic structure since this characteristic would demonstrate most readily any similarity in etiology of the epidemics occurring in the Soviet Union and in other countries.

During the second quarter the percentage of laboratory-confirmed cases of influenza dropped to 29%, and the attack rates of parainfluenza and adenoviral infection increased somewhat to 6.2% and 6.1% respectively. The number of strains of influenza isolated was slightly greater than 100.

Thus, the results of the laboratory tests also confirm that a decline of the influenza epidemic occurred in April and May.

The last influenza A2 epidemic in the USSR occurred in 1965, and it is interesting to compare the last 2 epidemics which were caused by different variants of the influenza A2 virus. The direction of the travel of the 1969 epidemic was opposite to that of the 1965 epidemic, i.e., it began in Leningrad at the end of December (28–30 December). In Moscow the first rise in incidence was recorded on 18 January 1965.

In February influenza epidemics were observed in the majority of cities of the Russian Soviet Federal Socialist Republic, Ukraine, Byelorussia, and, finally, towns of the Central Asian republics were also involved. The intensities of the rise and of the decline of the 1965 epidemic wave were less pronounced than these features of the epidemic caused by influenza virus A2/Hong Kong/68. Thus, for example, in most towns in 1965 the maximum number of cases was recorded from day 9 to day 17, and the epidemic lasted 25–30 days; the epidemic continued for about 3 months in the country as a whole, i.e., from January to March. The dissemination of the 1968–69 epidemic wave was considerably slower, as the increase in cases of influenza and ARD began in the middle of December 1968 in the Central Asian republics, and the epidemic ceased in a number of towns of the UkSSR and the RSFSR only in April or May. The total duration of the epidemic in the country exceeded 4 months and the peak incidence was recorded in many cities (Minsk, Dnepropetrovsk, Odessa, Rostov-on-Don, Volgograd, Kuibyshev, Gorky, Sverdlovsk and Kemerovo) on about day 15–day 20 and in some towns (Tbilisi and Kiev) on day 24–day 29. In separate towns of the Latvian, Byelorussian, and Tadzhik Soviet Socialist Republics there was a 2-fold maximum rise. The duration of the epidemic in towns was from 50 to 80 days, and the number of registered cases during the days of maximum rise in 1969 was less than that in 1965.

The epidemic associated with influenza virus A2/Hong Kong/68 was characterized by an unusual age distribution. During the rise of the epidemic and at the time of peak incidence, children under 7 years of age made up at the most one-quarter of the total registered cases in the majority of towns. Exceptions were Archangel, Kazan and Dyushambe where 33%, 34% and 46% of children were affected respectively. On the contrary, during the rise of the epidemic wave in 1965, more children were involved; for example, in Sverdlovsk the attack rate among children under 15 years of age was 2–2½ times higher than among adults, and in the Latvian Soviet Socialist Republic the attack rate among children under 14 years of age was 50%–54%. High indices of morbidity among children were recorded in Erivan, Kiev, Kazan and some other towns. It was estimated that 12.4% (about 30 million) of the total population of the USSR was affected during December 1968 and the first quarter of 1969 and 11.2% during the same period in 1964–65.

The study of some indices of immunity in a healthy population showed that 67.2% of the sera tested in 1965 and 26.5% of the sera tested in 1969 did not contain antibodies against influenza A2 virus or contained them only in a low titre (1 : 10). In order to determine the endurance of immunity in a healthy population during the epidemics in different towns, from 1853 to 4446 sera of donors were tested in the HI test for the presence of antibodies to influenza virus. The results of this study are summarized in Table 1.

Fig. 2 shows the average monthly incidence of influenza and ARD during the last 13 years (from the

TABLE 1

NUMBER OF SERA CONTAINING NO ANTIBODIES [a]

Virus strain	First quarter of 1965		First quarter of 1969	
	No. of persons examined	Percentage without antibodies	No. of persons examined	Percentage without antibodies
A	2 107	40.1	1 853	45.1
A1	2 033	46.9	2 271	34.3
A2	2 333	67.2	4 446	26.5
B	2 247	36.3	3 919	17.9

[a] Includes those with titre of <1 : 10.

first appearance of the new variant of influenza A2 virus) and shows the intensity of the epidemic associated with influenza virus A2/Hong Kong/68.

The curve of the 1969 epidemic was lower than that of the average maximum morbidity, even during the peak incidence, but was considerably higher than the curve of average morbidity for the period in 1957–68.

The facts mentioned above demonstrate that the spread of the epidemic wave associated with influenza virus A2/Hong Kong/68 was less rapid and less intense than in the 1965 epidemic, but continued longer and resulted in a larger proportion of the population experiencing the disease. For a more accurate determination of the number of persons

FIG. 2

AVERAGE ANNUAL TREND OF MORBIDITY OF INFLUENZA AND OTHER ACUTE RESPIRATORY DISEASES FOR THE PERIOD 1957–68, COMPARED WITH THE MORBIDITY IN 1969

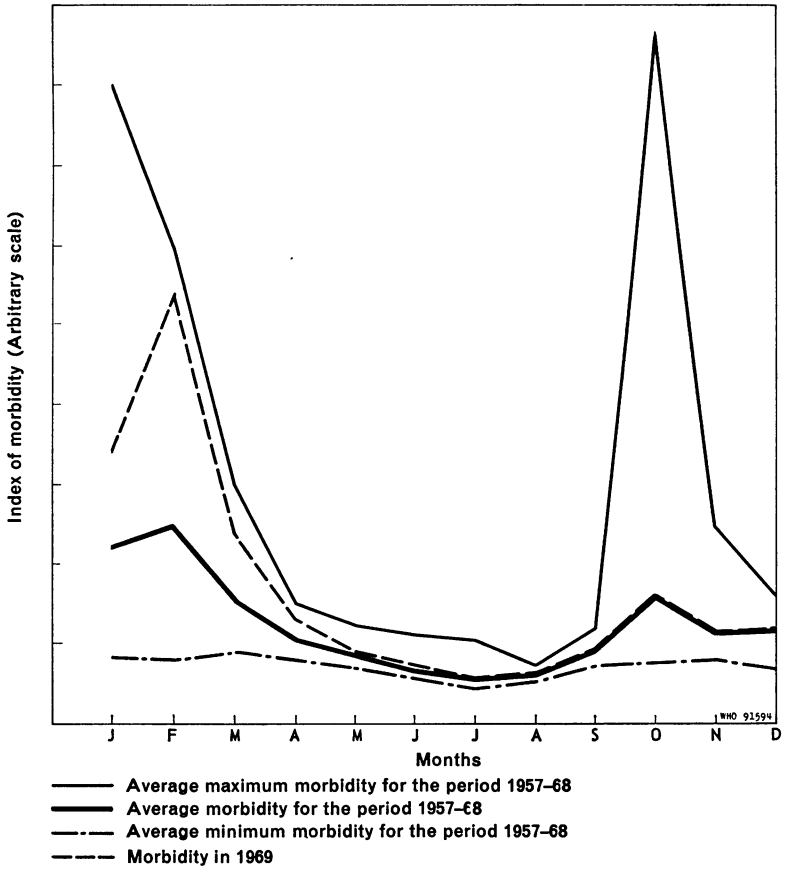


TABLE 2
ATTACK RATE OF INFLUENZA AND ARD DURING THE EPIDEMIC SEASON (NOVEMBER–APRIL)

Towns	Epidemic years		Interepidemic years
	1964-65	1968-69	1963-64
Riga	22.5	37.5	13.3
Murmansk	29.4	24.7	15.8
Leningrad	35.7	39.0	17.7
Moscow	36.9	43.1	19.7
Kiev	29.4	34.6	15.2
Volgograd	24.3	26.2	10.1
Erivan	15.7	13.1	8.7
Dyushambe	15.9	14.3	8.9
Sverdlovsk	27.0	29.2	13.0
Vladivostok	13.8	19.1	6.1

affected, it would be better to consider the epidemic season with respect to influenza and ARD, i.e., from November to April. Table 2 shows some figures for the morbidity in different towns in the USSR during the 1964–65 and 1968–69 epidemic seasons and the interepidemic winter of 1963–64.

The 1968–69 epidemic associated with a variant of A2 influenza virus, as well as the 1957 pandemic, arose in South-East Asia and spread over the whole world. Therefore, as we noted earlier, South-East Asia might be considered as the epidemic centre of the new epidemic wave and the site of formation of new antigenic variants of the virus. In Europe the 1964–65 influenza virus A2 epidemic was first recorded in eastern Germany; it then moved to the Soviet Union and only after that, though not very intensively, affected the other European countries of Finland, Sweden, Poland, Hungary and Romania. An increase in influenza incidence was also observed in the USA. In 1968–69 the epidemic wave of influenza virus A2/Hong Kong/68 spread to most European countries almost simultaneously: the epidemic peak was recorded in January not only in the USSR, but also in France, the Federal Republic of Germany, Switzerland, Yugoslavia, Hungary, Czechoslovakia, Poland, Sweden, Finland, as well as in the United States of America.

The spread of influenza in the USSR in 1969, the intensity of the rise and of the decline of the epidemic wave, the duration of the epidemic, the unusual age distribution, especially at the peak of the epidemic, are characteristic features that distinguish the last epidemic from the previous one in 1965. These features are apparently related, on the one hand, to an antigenic relationship between the A2 /Hong Kong/68 virus and the A2 viruses that were circulating before it, since immunity to the old variants of influenza A2 partly protected the population against the disease. The study of the isolated strains demonstrated that although the influenza virus A2/Hong Kong/68 differs from the strain A2/Singapore/57 it is somewhat more closely related in its antigenic structure and biological properties to the viruses circulating from 1957 to 1962 than to the A2 influenza viruses encountered from 1964 to 1967.

On the other hand, in 1968–69 prophylactic and anti-epidemic measures performed by public health services exerted some influence on the course of the epidemic and indubitably resulted in a reduction of the sharp rise of the epidemic, in a decrease of fatal cases and thus in the absence of large epidemic foci.

We believe that the ability to predict an epidemic, even though it may be only a short time in advance, is valuable as it allows practical measures to be taken by public health services. A prediction of the expected morbidity for the spring–autumn period of 1968–69 was prepared by the USSR Regional Influenza Centre in August 1968 and was communicated to the public health services of the country. The subsequent happenings have proved its correctness.

On the grounds of statistical and epidemiological data and on the results of experiments concerned with the study of the circulating influenza viruses, one may expect an increase in the incidence of influenza B during the autumn–winter seasons of 1969–70. Side by side with this, in towns where only a small proportion of the population experienced the disease during the season of 1968–69, an increase in morbidity due to variants of influenza A2/Hong Kong/68 may occur.

In conclusion we should like to emphasize the usefulness of international collaboration in the study of the epidemiology of influenza.